Patent
Attorney's Docket No. 030681-361

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Sung-jin KIM	)	Group Art Unit: Unassigned
	)	
Application No.: New Application	)	Examiner: Unassigned
	)	
Filed: Herewith	)	
	)	
For: ENCODING METHOD AND APPARATUS OF DEFORMATION INFORMATION OF 3D OBJECT	)	

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination on the merits, kindly amend the above-captioned application as follows:

IN THE SPECIFICATION:

Kindly add the following paragraph on page 1, after the title of the invention and before the "Background of the Invention," --Priority is claimed to Patent Application Numbers 2001-10603 filed in the Republic of Korea on February 28, 2001 and 2001-40708 filed in the Republic of Korea on July 7, 2001, herein incorporated by reference.--

Kindly replace page 9, paragraph beginning at line 9

Referring to FIGS. 3 and 4, a encoding apparatus 200 of the first preferred embodiment of the present invention includes a parser 205, a demultiplexer 210, a vertex

connectivity processing unit 215, an Adaptive Differential Pulse Code Modulation (ADPCM) processing unit 220, a quantization unit 230, and an entropy encoding unit 235. To perform the inverse of the encoding process, a decoding apparatus 250 includes an entropy decoding unit 255, a demultiplexer 260, a vertex connectivity processing unit 265, an inverse quantization unit 270, an inverse ADPCM processing unit 275, and a buffer 280. Here, the decoding apparatus 250 performs the inverse of the encoding process performed in the encoding apparatus 200. Therefore, for brevity only the encoding operation of the encoding apparatus 200 will be explained.

Kindly replace page 21, paragraph beginning at line 25

FIG. 22 is a diagram of an example of the structure of a compressed bit stream generated by the encoding apparatus of FIGS. 17 and 18. Referring to FIG. 22, each of the bit streams 440 and 540 of FIGS. 17 and 18, which is finally generated by the encoding apparatus 400 and 500, includes header information 4400 and key value information 4405. Header information 4400 and key value information 4405 indicates information that is processed in one CI node. The header information 4400 is provided as a condition of inverse quantization to be performed in the inverse quantization units 475 and 575 in order to reconstruct the CI node in the decoding apparatuses 450 and 550. As a preferable example 4415, the header information 4400 is formed with the quantization size of key values (Qstep_KV), the quantization step of encoding bits of X (Qstep_X) in key values, the quantization step of encoding bits of Y (Qstep_Y) in key values, the quantization step of encoding bits of Z (Qstep_Z) in key values, and minimum values (MinX, MinY, and

MinZ) and maximum values (MaxX, MaxY, and MaxZ) which are used in normalizing differential values from the quantization unit 430 to values between 0 and 1 inclusive. An example 4410 shows the structure of the key values information 4405, which includes key value information according to the BFS search order.

IN THE CLAIMS:

Kindly replace claims 30, 33, 34, 38 and 43 as follows:

30. (Amended) The encoding apparatus of claim 28, wherein the field data input unit comprises:

a parse for dividing node information into a Coordinate Interpolator (CI) node and an IndexFaceSet (IFS) node; and

a demultiplexer for extracting field data formed with keys and key values from the CI node, and extracting Coordinate Index (CIdx) field data from the IFS node.

33. (Amended) The encoding apparatus of claim 28, wherein the ADPCM processing unit comprises:

a differential value generator for receiving the vertex connectivity information, coordinate information of the IFS node as the related information, and key values, and generating differential values among all position values of the key values change in a 3D space;

a predictor for extracting data redundancy in the differential values according to the spatial correlation among vertices based on the vertex connectivity information; and

Differential Pulse Code Modulation (DPCM) processors for DPCM processing each of keys, and key values of which data redundancy due to the spatial correlation is extracted.

34. (Amended) The encoding apparatus of claim 28, wherein the entropy encoding unit generates a bit stream from which redundancy among bits in the quantized values is removed using the probability of bit symbol occurrence.

38. (Amended) The encoding apparatus of claim 36, wherein the field data input unit comprises:

a parse for dividing node information into a Coordinate Interpolator (CI) node and an IndexFaceSet (IFS) node; and

a demultiplexer for extracting field data formed with keys and key values from the CI node, and extracting Coordinate Index (CIdx) field data from the IFS node.

43. (Amended) The encoding apparatus of claim 36, wherein the entropy processing unit removes the redundancy among bits in the quantized values, using the probability of bit symbol occurrence, and outputs the result as a bit stream.

Kindly add new claims 45-49 as follows:

--45. (New) The encoding apparatus of 29, wherein the field data input unit comprises:

a parse for dividing node information into a Coordinate Interpolator (CI) node and an IndexFaceSet (IFS) node; and

a demultiplexer for extracting field data formed with keys and key values from the CI node, and extracting Coordinate Index (CIdx) field data from the IFS node.

46. (New) The encoding apparatus of 29, wherein the ADPCM processing unit comprises:

a differential value generator for receiving the vertex connectivity information, coordinate information of the IFS node as the related information, and key values, and generating differential values among all position values of the key values change in a 3D space;

a predictor for extracting data redundancy in the differential values according to the spatial correlation among vertices based on the vertex connectivity information; and

Differential Pulse Code Modulation (DPCM) processors for DPCM processing each of keys, and key values of which data redundancy due to the spatial correlation is extracted.

47. (New) The encoding apparatus of 29, wherein the entropy encoding unit generates a bit stream from which redundancy among bits in the quantized values is removed using the probability of bit symbol occurrence.

48. (New) The encoding apparatus of 37, wherein the field data input unit comprises:

a parse for dividing node information into a Coordinate Interpolator (CI) node and an IndexFaceSet (IFS) node; and

a demultiplexer for extracting field data formed with keys and key values from the CI node, and extracting Coordinate Index (CIdx) field data from the IFS node.

49. (New) The encoding apparatus of 37, wherein the entropy processing unit removes the redundancy among bits in the quantized values, using the probability of bit symbol occurrence, and outputs the result as a bit stream.--

REMARKS

Claims 30, 33, 34, 38 and 43 have been amended and claims 45-49 have been added to remove multiple dependency from the claims. The priority documents have been incorporated by reference. Favorable action on the merits is respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: ______________________
Charles F. Wieland III
Registration No. 33,096

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

Date: February 25, 2002

Attachment to Amendment

Marked-up Copy

Page 9, Paragraph Beginning at Line 9

Referring to FIGS. 3 and 4, a encoding apparatus 200 of the first preferred embodiment of the present invention includes a parser 205, a demultiplexer 210, a vertex connectivity processing unit 215, an Adaptive Differential Pulse Code Modulation (ADPCM) processing unit 220, a quantization unit 230, and an entropy encoding unit 235. To perform the inverse of the encoding process, a decoding apparatus 250 includes an entropy decoding unit 255, a demultiplexer 260, a vertex connectivity processing unit 265, an inverse quantization unit 270, an inverse ADPCM processing unit 275, and a buffer 280. Here, the decoding apparatus [250performs] <u>250 performs</u> the inverse of the encoding process performed in the encoding apparatus 200. Therefore, for brevity only the encoding operation of the encoding apparatus 200 will be explained.

Page 21, Paragraph Beginning at Line 25

FIG. 22 is a diagram of an example of the structure of a compressed bit stream generated by the encoding apparatus of FIGS. 17 and 18. Referring to FIG. 22, each of the bit streams 440 and 540 of FIGS. 17 and 18, which is finally generated by the encoding apparatus 400 and 500, includes header information 4400 and key value information 4405. Header information 4400 and key value information 4405 indicates information that is processed in one CI node. The header information 4400 is provided as a condition of

Attachment to Amendment

Marked-up Copy

inverse quantization to be performed in the inverse quantization units 475 and 575 in order to reconstruct the CI node in the decoding apparatuses 450 and 550. As a preferable example 4415, the header information 4400 is formed with the quantization size of key values (Qstep_KV), the quantization step of encoding bits of X (Qstep_X) in key values, the quantization step of encoding bits of Y (Qstep_Y) in key values, the quantization step of encoding bits of Z (Qstep_Z) in key values, and minimum values (MinX, MinY, and MinZ) and maximum values (MaxX, MaxY, and MaxZ) which are used in normalizing differential values from the quantization unit 430 to values between 0 and 1 inclusive. An example [44100] 4410 shows the structure of the key values information 4405, which includes key value information according to the BFS search order.

Attachment to Amendment

Marked-up Claims

30. (Amended) The encoding apparatus of [any one of claims 28 and 29] claim 28, wherein the field data input unit comprises:

a parse for dividing node information into a Coordinate Interpolator (CI) node and an IndexFaceSet (IFS) node; and

a demultiplexer for extracting field data formed with keys and key values from the CI node, and extracting Coordinate Index (CIdx) field data from the IFS node.

33. (Amended) The encoding apparatus of [any one of claims 28 and 29] claim 28, wherein the ADPCM processing unit comprises:

a differential value generator for receiving the vertex connectivity information, coordinate information of the IFS node as the related information, and key values, and generating differential values among all position values of the key values change in a 3D space;

a predictor for extracting data redundancy in the differential values according to the spatial correlation among vertices based on the vertex connectivity information; and

Differential Pulse Code Modulation (DPCM) processors for DPCM processing each of keys, and key values of which data redundancy due to the spatial correlation is extracted.

Attachment to Amendment

Marked-up Claims

34. (Amended) The encoding apparatus of [any one of claims 28 and 29] claim 28, wherein the entropy encoding unit generates a bit stream from which redundancy among bits in the quantized values is removed using the probability of bit symbol occurrence.

38. (Amended) The encoding apparatus of [any one of claims 36 or 37] claim 36, wherein the field data input unit comprises:

a parse for dividing node information into a Coordinate Interpolator (CI) node and an IndexFaceSet (IFS) node; and

a demultiplexer for extracting field data formed with keys and key values from the CI node, and extracting Coordinate Index (CIdx) field data from the IFS node.

43. (Amended) The encoding apparatus of [any one of claims 36 or 37] claim 36, wherein the entropy processing unit removes the redundancy among bits in the quantized values, using the probability of bit symbol occurrence, and outputs the result as a bit stream.